SUPPORT FOR THE AMENDMENT

This Amendment amends Claim 1. Support for the amendments is found in the specification and claims as originally filed. In particular, support for Claim 1 is found in the specification at page 13, line 20 to page 14, line 2; page 26, lines 7-10; and page 30, lines 14-17. No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 1-7 will be pending in this application. Claim 1 is independent.

REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

The present invention provides a magnetic recording medium, with improved strength and durability, comprising a lower non-magnetic layer on one surface of a non-magnetic support, an upper magnetic layer on the lower non-magnetic layer, and a back coat layer on the other surface of the non-magnetic support.

Claims 1-7 are rejected under 35 U.S.C. § 103(a) over JP 10-011736 ("Hattori") in view of U.S. Patent No. 5,443,913 ("Kohno").

Hattori discloses a magnetic tape containing a non-magnetic layer and a magnetic layer, in this order, on one side of a non-magnetic base, and a back coating layer on the other side of the base. Hattori at abstract.

Hattori discloses that the non-magnetic layer contains mainly non-magnetic powder and binder. Examples of the nonmagnetic powder are non-magnetic inorganic powder and carbon black. Hattori at [0012].

Hattori discloses that the magnetic layer contains ferromagnetic powder, binder, and abrasive and that a Mohs hardness of the abrasive is 5 or above. Hattori at [0019]; [0025].

Hattori discloses that the back coating layer contains carbon black, soft inorganic powder having an average particle size of 30 to 50 μm and Mohs hardness of 3 to 4.5, hard inorganic powder having an average particle size of 80 to 250 μm and Mohs hardness of 5 to 9, and binder. Hattori at [0026]; [0032]; [0035].

Kohno is cited for "teaching the desirability" of surface roughness in the ranges recited in Claims 3-4 and 7. Office Action at page 5, lines 1-3.

Any *prima facie* case of obviousness based on the cited prior art is rebutted by the significant increase in durability (which is reflected in a significant decrease in coating abrasion and error rate after durability testing) that is achieved by the present invention over the range defined by independent Claim 1 where "a ratio (S_{BC}/S_{MC}) of a SENDUST abrasion volume S_{BC} by the back coat layer to the SENDUST abrasion volume S_{MC} by the magnetic layer is in the range of 0.5 to 3.0".

The SENDUST abrasion volume reflects the coating strength and durability of each layer.

> The coating strength of each layer is determined by running a magnetic tape on a SENDUST material under predetermined conditions and measuring the volume of abraded material (the abraded volume reflects the ability of the tape to abrade). Specifically, the larger the abraded volume of the SENDUST material, the higher the coating strength. Specification at page 6, lines 14-20.

A key factor in the present invention is the relationship between the coating strength of the back coat layer and the coating strength of the magnetic layer. Specification at page 6, lines 12-14.

> The magnetic recording medium of the present invention has an abrasion volume ratio (S_{BC}/S_{MC}) of the SENDUST abrasion volume S_{BC} by the back coat layer to the SENDUST abrasion volume S_{MC} by the magnetic layer of 0.5 to 3.0, preferably 0.5 to 2.0. The magnetic recording medium having the S_{BC}/S_{MC} ratio within the specified range is less susceptible to scratches and abrasions on the magnetic layer during runs on a drive even upon the high-speed sliding of the back coat layer against the magnetic layer. Should the S_{BC}/S_{MC} ratio exceed 3.0, then the coating strength of the back coat layer will become too high relative to the coating strength of the magnetic layer, making

> the magnetic layer susceptible to scratches inflicted by the back coat layer during runs on a drive. On the other hand, if the S_{BC}/S_{MC} ratio is smaller than 0.5, then the coating strength of the magnetic layer will become too high relative to the coating strength of the back coat layer, making the back coat layer susceptible to scratches inflicted by the magnetic layer during runs on a drive. Specification at page 8, lines 1-19.

Tables 1-2, reproduced below, demonstrate the significant decrease in coating abrasion and error rate after durability testing that is achieved by the present invention over the range of S_{BC}/S_{MC} of 0.5 to 3.0.

Table 1

	Lower non-magnetic layer	Magnetic powder of magnetic layer MC	Back coat layer BC						SENDUST abrasion volume (x 10^4(pm)^3/m)		
			Carbon black	Parts by weight	Inorganic powder	Parts by weight	Binder resin	Parts by weight*	S_{BC}	S_{MC}	S_{BC}/S_{MC}
Comparative Example 1	Disposed	Metal powder 1	BP800 + BP130	75 10	$BaSO_4$	15	Vinyl chloride/ poly-urethane	100	4.0	1.2	3.3
Example 1									3.2	1.2	2.7
Example 2									2.1	1.2	1.8
Example 3									0.7	1.2	0.6
Comparative Example 2									0.4	1.1	0.4
Comparative Example 3			BP800 + BP130	90 10	Al_2O_3	2	Nitro-cellulose /poly-urethane	83	4.2	1.2	3.5
Example 4					Al_2O_3	1			1.6	1.2	1.3
Example 5					Al_2O_3	0.5			1.2	1.2	1.0
Example 6					Fe_2O_3	2			1.2	1.2	1.0
Example 7			BP800 + BP130	75 10	$CaCO_3$	15			0.8	1.2	0.7
Example 8					$BaSO_4$	15			0.9	1.2	0.8
Example 9	Disposed	Metal powder 2	BP800 + BP130	90 10	Al_2O_3	1			1.6	0.9	1.8
Comparative Example 4	Non-disposed	Metal powder 1	BP800 + BP130	75 10	$BaSO_4$	15	Vinyl chloride/ Poly-urethane	100	4.0	3.0	1.3
Comparative Example 5									4.0	2.4	1.7

*: Parts by weight of solid resin content

Table 2

	SENDUST abrasion volume (x 10^4(pm)^3/m)			Surface roughness Ra(nm)		AFM surface roughness Ra(nm) MC	Coating abrasion after durability testing		Initial error rate (errors/ MB)	Error rate after durability testing (errors/ MB)
	S_{BC}	S_{MC}	S_{BC}/S_{MC}	BC	MC		BC	MC		
Comparative Example 1	4.0	1.2	3.3	23.4	5.1	5.5	B	AA	1.5	3.1
Example 1	3.2	1.2	2.7	18.5	5.0	5.5	A	AA	0.8	1.0
Example 2	2.1	1.2	1.8	12.2	4.9	5.5	AA	A	0.5	0.7
Example 3	0.7	1.2	0.6	10.0	4.9	5.5	AA	A	0.8	1.0
Comparative Example 2	0.4	1.1	0.4	7.2	4.8	5.5	AA	C	1.0	1.8
Comparative Example 3	4.2	1.2	3.5	16.1	5.0	5.5	B	AA	1.0	1.9
Example 4	1.6	1.2	1.3	15.5	4.9	5.5	AA	AA	0.5	0.6
Example 5	1.2	1.2	1.0	14.9	4.9	5.5	AA	AA	0.5	0.7
Example 6	1.2	1.2	1.0	15.5	4.9	5.5	AA	AA	0.5	0.7
Example 7	0.8	1.2	0.7	13.1	4.9	5.5	AA	A	0.5	0.9
Example 8	0.9	1.2	0.8	14.5	4.9	5.5	AA	A	0.5	0.8
Example 9	1.6	0.9	1.8	14.0	3.9	4.5	AA	AA	0.3	0.6
Comparative Example 4	4.0	3.0	1.3	23.4	7.0	8.1	AA	AA	Impossible to measure*	-
Comparative Example 5	4.0	2.4	1.7	23.4	6.2	6.5	AA	AA	2.0	8.5

*: For the magnetic tape of Comparative Example 4, the ability of the magnetic layer to abrade was so high that a smear was formed on MR head, making the measurement of the error rate impossible.

In Example 1 and Comparative Examples 1-2, the same coatings were respectively used for the magnetic layer and back coat layer. Nevertheless, Comparative Examples 1-2 provided significantly inferior durability results compared to Example 1.

In Comparative Example 1, S_{BC}/S_{MC} was 3.3, which is greater than independent Claim 1's range of S_{BC}/S_{MC} of 0.5 to 3.0. The coating abrasion of the back coat layer (BC) after durability testing was rated "B" (i.e., "2 to 10 scratches were observed per field of vision at x100 magnification" (Specification at page 66, lines 10-11)). The error rate after durability testing was 3.1 errors/MB.

> In the magnetic [tape] of Comparative [Example] 1 ..., the coating strength of the back coat layer was so much higher as compared to the coating strength of the magnetic layer that the magnetic layer suffered significant scratches after durability testing. Specification at page 69, lines 12-16.

In Comparative Example 2, S_{BC}/S_{MC} was 0.4, which is less than independent Claim 1's range of S_{BC}/S_{MC} of 0.5 to 3.0. The coating abrasion of the magnetic layer (MC) after durability testing was rated "C" (i.e., "11 or more scratches were observed per field of vision at x100 magnification" (Specification at page 66, lines 12-13)). The error rate after durability testing was 1.8 errors/MB.

> In the magnetic tape of Comparative Example 2 ..., the coating strength of the magnetic layer was so much higher as compared to the coating strength of the back coat layer that the back coat layer suffered significant scratches after durability testing. Specification at page 69, lines 16-22.

In contrast to Comparative Examples 1-2, in Example 1 S_{BC}/S_{MC} was 2.7, which is within independent Claim 1's range of S_{BC}/S_{MC} of 0.5 to 3.0. The coating abrasion of the back coat layer (BC) after durability testing was rated "A" (i.e., "one or no scratch was observed per field of vision at x100 magnification" (Specification at page 66, lines 13-14)). The coating abrasion of the magnetic layer (MC) after durability testing was rated "AA" (i.e.,

"no scratches were observed" (Specification at page 66, line 7)). The error rate after durability testing was 1.0 errors/MB.

The comparison of Example 1 with Comparative Examples 1-2 shows that a significant increase in durability (which is reflected in a significant decrease in coating abrasion and error rate after durability testing) is achieved by the present invention over the range defined by independent Claim 1 where "a ratio (S_{BC}/S_{MC}) of a SENDUST abrasion volume S_{BC} by the back coat layer to the SENDUST abrasion volume S_{MC} by the magnetic layer is in the range of 0.5 to 3.0".

In Example 4 and Comparative Example 3, the same coating was used for the magnetic layer. In addition, the same coating was used for the back coat layer, except for the amount of Al_2O_3. Nevertheless, Comparative Example 3 provided significantly inferior durability results compared to Example 4.

In Comparative Example 3, S_{BC}/S_{MC} was 3.5, which is greater than independent Claim 1's range of S_{BC}/S_{MC} of 0.5 to 3.0. The coating abrasion of the back coat layer (BC) after durability testing was rated "B" (i.e., "2 to 10 scratches were observed per field of vision at x100 magnification" (Specification at page 66, lines 10-11)). The error rate after durability testing was 1.9 errors/MB.

> In the magnetic [tape] of Comparative [Example] ... 3 ..., the coating strength of the back coat layer was so much higher as compared to the coating strength of the magnetic layer that the magnetic layer suffered significant scratches after durability testing. Specification at page 69, lines 12-16.

In contrast to Comparative Example 3, in Example 4 S_{BC}/S_{MC} was 1.3, which is within independent Claim 1's range of S_{BC}/S_{MC} of 0.5 to 3.0. After durability testing, the coating abrasion of the back coat layer (BC) was rated "AA" (i.e., "no scratches were observed" (Specification at page 66, line 7)). The error rate after durability testing was 0.6 errors/MB.

The comparison of Example 4 with Comparative Example 3 shows that a significant increase in durability (which is reflected in a significant decrease in coating abrasion and error rate after durability testing) is achieved by the present invention over the range defined by independent Claim 1 where "a ratio (S_{BC}/S_{MC}) of a SENDUST abrasion volume S_{BC} by the back coat layer to the SENDUST abrasion volume S_{MC} by the magnetic layer is in the range of 0.5 to 3.0".

The cited prior art is silent about the significant increase in durability that is achieved by the present invention over the range defined by independent Claim 1 where "S_{BC}/S_{MC} ... is in the range of 0.5 to 3.0". The Office Action admits that Hattori does not disclose a SENDUST abrasion volume for the magnetic layer or the back coating layer. Office Action at page 4, section 4, lines 7-8.

Thus, any *prima facie* case of obviousness based on the cited prior art is rebutted. As a result, the rejection under 35 U.S.C. § 103(a) should be withdrawn.

Claims 1-7 are rejected under 35 U.S.C. § 112, first paragraph, because assertedly the specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to practice the invention commensurate in scope with these claims without undue experimentation. To obviate the rejection, Claim 1 is amended to specify the respective compositions of the lower non-magnetic layer, the upper magnetic layer, and the back coat layer.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Respectfully submitted,

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